International Journal of Sport Nutrition and Exercise Metabolism, 2013, 23, S1-S15

INTERNATIONAL JOURNAL OF
SPORT NUTRITION AND
EXERCISE METABOLISM
www.IJSNEM-Journal.com
SPECIAL ISSUE

Abstracts From the December 2012 International Sports and Exercise Nutrition Conference in Newcastle upon Tyne

Effect of *Eurycoma longifolia* on stress hormones and psychological mood state in moderately stressed subjects

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Eurycoma longifolia is a medicinal plant commonly called Tongkat ali and "Malaysian ginseng." The roots are used as a traditional "antiaging" remedy, while modern dietary supplements are intended to improve libido/energy, restore hormonal balance (cortisol/testosterone levels), and enhance sports performance and weight loss. Laboratory evidence shows that *Eurycoma* peptides may stimulate release of free testosterone from its binding protein (SHBG) and improve hormone profiles. Rodent feeding studies have demonstrated improved sex drive, balanced hormone profiles, and enhanced physical function. Human supplementation trials show reduced fatigue, heightened energy/mood, and improved well-being in subjects consuming Tongkat ali. In the present study, 63 subjects (32 men and 31 women) were prescreened for moderate levels of psychological stress and supplemented with a standardized hot-water extract of Tongkat ali root (200 mg/day Physta™, Biotropics Malaysia) or a look-alike placebo for 4 weeks. There were no changes in markers of liver function (AST/ALT), body weight, or body fat percentage. Mood-state parameters (POMS) showed mixed results, with no effect observed for subscales of depression, vigor, or fatigue, whereas improvements ($p < .05$) were found in the Physta group for tension (–11%), anger (–12%), and confusion (–15%). Hormone profile (salivary cortisol and testosterone) was improved ($p < .05$) by Physta supplementation, with reduced cortisol exposure (–16%), increased testosterone status (+37%), and improved cortisol:testosterone ratio (–36%). These results indicate that daily supplementation with Tongkat ali (Physta) improves stress-hormone profile and certain mood-state parameters, suggesting that this "ancient" remedy may be an effective approach to shielding the body from the detrimental effects of "modern" chronic stress.

Effect of carbohydrate-electrolyte-protein solution on hydration

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The loss of circulating fluid during exercise is an important factor in causing fatigue. Drinking a formulated solution containing carbohydrate and electrolytes during exercise has been shown to be helpful for fluid retention. Recently, it has been suggested that the addition of protein to carbohydrate-electrolyte drinks enhanced postexercise rehydration. However, it is not clear whether it will be helpful for the maintenance of hydration status during exercise. We investigated the effects of carbohydrate-electrolyte-protein (CEP) solution ingested during 60 min cycling on hydration status. Eight males (age 29 ± 4 years, body weight 66.2 ± 9.1 kg, VO_{2max} 48.4 ± 5.5 ml/kg/min) performed two trials in a counterbalanced crossover study design. In each trial, the subjects ingested distilled water (DW) or a CEP solution during the 60 min cycling at 70% VO_{2max}. The CEP solution contained 42 g/L carbohydrate, 21 g/L whey protein, 15.3 mmol/L sodium, and 2.3 mmol/L potassium. Solutions were provided in a volume of 2.0 ml/kg preexercise body weight at 0, 15, 30, and 45 min during cycling. Body weight and urine samples were collected before and after exercise, and the capillary blood samples were obtained at 15-min intervals during exercise. During the 60 min cycling, subjects drank about 530 ml fluid in the two trials ($p > .05$). After exercise, no difference was found in body weight loss between the two trials (DW vs. CEP, 0.96% vs. 0.87%, $p > .05$). The total urine output and urine specific gravity after exercise were similar between the two trials ($p > .05$). At the end of exercise, a higher glucose concentration was found in CEP trial than that in the DW trial (CEP vs. DW: 4.69 ± 0.80 vs. 3.56 ± 0.51 mmol/L, p .05). Compared with DW, the CEP solution showed no extra benefits for the maintenance of hydration status during 60 min cycling.

The effects of coffee on the hydration status of free-living individuals

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It is often suggested that coffee causes dehydration and should be avoided or reduced to maintain fluid balance. The aim of this study was to directly compare the chronic effects of moderate coffee consumption against water across a range of standardized hydration assessment techniques. In a counterbalanced crossover design, 50 habitual coffee-drinking males aged 18–50 years underwent two trials; coffee (4 mg/kg caffeine) (C) or water (W) provided in 4 × 200 g/d, for 2 consecutive days. All food and fluids were provided and no exercise was permitted. Daily urinary measures (USG, osmolality, 24-hr

volume, sodium [Na^+], potassium [K^+] and creatinine) and hematological hydration markers (hematocrit, serum osmolality, total plasma protein, creatinine, blood urea nitrogen, serum Na+ and K+) were measured throughout both conditions. Additional measures of body mass (BM) and total body water (TBW) via ingestion of deuterium oxide and analysis with isotope ratio mass spectrometry were collected throughout both trials. Plasma was analyzed for caffeine to confirm compliance. No differences were observed between trials across any hematological markers. No differences between trials were observed in 24-hr urine volume, USG, osmolality, or creatinine ($p > .05$). Although mean urinary Na^+ excretion was higher in C than W ($p = .02$), no differences in serum Na^+ concentrations were observed (141.2 ± 2.5 and 141.2 ± 2.4 mmol/L for C and W trials, respectively). There were no changes in TBW from beginning to end of either trial or differences between conditions. No differences in BM were found between trials, but a small but progressive daily fall was observed within both conditions ($p < .05$). Mean decrease in BM across both trials was 0.39 ± 0.5 kg. These data suggest that coffee, when consumed in moderation by caffeine-habituated males, contributes to daily fluid requirement and does not have a detrimental effect on fluid balance.

An analysis of the effects of acute dehydration on balance, anaerobic performance, and cognitive function

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Dehydration resulting in a reduction of body mass by 2% has been shown to be associated with impairments in both prolonged endurance work capacity and possibly cognitive performance. In contrast, the effects of dehydration on short-duration activities and task-related performance remain unclear. The purpose of this study, therefore, was to analyze the effects of acute dehydration on balance, anaerobic performance, and cognitive function in a young healthy male population. Twelve healthy male subjects (age 21 ± 2 years; height 180.9 ± 4.4 m; body mass 85.3 ± 8.9 kg; BMI 26.7 ± 2.8 k/gm^2) underwent passive dehydration until a reduction in body mass of 4% was attained. A battery of tests assessing cognitive function (computerized and pen and paper), balance, and anaerobic performance were completed in a euhydrated and dehydrated state. Twelve age- and BMI-matched male individuals acted as controls (age 21 ± 1 years; height 177.9 ± 7.3 m; body mass 81.1 ± 10.8 kg; BMI 24.3 ± 2.6 kg/m^2), completing both of the trials in a euhydrated state. A mean body mass loss of 4.2% ± .7% was recorded in the dehydration group. Balance performance reduced for both the left ($p \leq .05$) and right ($p \leq .01$) lower limb. In addition, an increase in anaerobic fatigue ($p \leq .01$) was seen in the dehydration group where the percentage power drop increased from 50% ± 8% to 58% ± 12%. No differences ($p \leq .05$) exist in any of the cognitive function tests performed, but many individual differences exist. Results from this study indicate that a rapid loss in body mass through passive dehydration in association with an increase in urine specific gravity, as commonly seen in various weight-category sports, results in decreased balance performance and increased anaerobic fatigue. In contrast, no such decrements were shown in cognitive performance.

Nutrient intake and hydration status of professional jockeys while "making weight" for racing and the associated impact on cognitive function

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Professional jockeys have been reported to engage in acute and severe weight-loss practices in order to "make weight" for racing. Severely restricted energy intake and dehydrating mechanisms are the primary means reported to achieve stipulated weight standards. We examined nutritional intake in jockeys while "making weight" for racing and to assess the impact of said weight loss on cognitive function. Nine jockeys (24 ± 7 years; 1.68 ± 0.5 m; 58.2 ± 5.3 kg; 20.74 ± 1.74 kg/m^2) and 9 age-, gender-, and BMI-matched controls took part in this study, which consisted of two test trials. Jockeys were required to reduce their body mass by 4% in the 48 hr between trials using what means they typically would for racing. Food and weight-loss diaries were maintained throughout the weight-loss period. Hydration status was estimated from the specific gravity of urine samples. Simple reaction time, choice reaction time, executive function, and working memory were assessed through completion of a computerized test battery. The jockey group reduced their body mass by 3.6% ± 0.9% in the 48 hr between trials. Usg significantly increased from 1.019 ± 0.004 to 1.028 ± 0.005 ($p < .01$). Nutritional intake during the weight-loss period showed a severely insufficient intake of virtually all macro- and micronutrients. All participants reported restricted fluid and fuel intake as the primary means used to achieve weight loss. Sixty-seven percent reported using additional weight-loss techniques, which focused primarily around active and passive dehydration. No aspect of cognitive function was affected following the body mass loss in the jockey group. Acute body mass loss in this group appeared to necessitate the use of severe energy-restricting and dehydrating techniques, which may have a number of health- and performance-related consequences for these athletes. No aspect of cognitive function tested was affected by the protocol employed in this study.

The effects of 1 week of oral S-adenosylmethionine supplementation on cycling performance and thermoregulation in warm conditions

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The onset of fatigue during endurance exercise in warm conditions appears to be at least partly mediated through mechanisms within the central nervous system. S-adenosylmethionine (SAMe) is a primary methyl group donor, involved in the metabolism of several neurotransmitters and in creatine synthesis and it has been used to treat depression. It is not yet known what role SAMe may have in exercise performance. With local ethics committee approval, 8 physically active males ($M \pm SD$

age 26 ± 4 years; height 1.79 ± 0.07 m; body mass 76.3 ± 10.2 kg; VO_{2max} 55.7 ± 4.0 ml/kg/min) were recruited to examine the effect of a weeklong oral administration of SAMe (2 × 800 mg/day) on time to exhaustion in a warm environment (30.2 ± 0.2°C, 50% ± 1% relative humidity). Subjects completed a VO_{2max} test and a familiarization trial before a randomized, double-blind, placebo-controlled crossover design was employed. Trials consisted of cycle exercise at a power output equivalent to 70% VO_{2max} to volitional exhaustion. Heart rate, skin and core temperature, and ratings of perceived exertion and thermal comfort were recorded throughout exercise. Blood samples were collected at rest, every 15 min of exercise, and at exhaustion. No difference in time to exhaustion was observed between the placebo (67.5 ± 12.4 min) and SAMe (68.5 ± 12.0 min) trials (p = .857). Serum prolactin concentration (p = .009) and weighted mean skin temperature (p = .015) were elevated during exercise in the SAMe trial compared to placebo. No further differences were found between trials in the other measures, and no order effects were observed. These results suggest that a weeklong dosing protocol of SAMe does not influence time to exhaustion in warm conditions, despite evidence supporting an effect on the central nervous system and thermoregulation.

Postprandial glucose-dependent insulinotropic peptide1-42, glucagon-like peptide-1, and insulin concentrations following high-calcium meal ingestion

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High calcium intake enhances fat loss under energy restriction which could be explained, in part, by greater fat oxidation (Gonzalez et al.,. *Obes Rev* 2012, 13, 848–857) and appetite control (Ping Delfos & Soares, *Clin Nutr* 2011, 30, 376–383). The underlying mechanisms are still unclear. Calcium perfusion of rodent intestine stimulates glucose-dependent insulinotropic peptide (GIP) and glucagon-like peptide-1 (GLP-1) secretion (Mace et al., *J Physiol* 2012, 590, 2917-2936), which are implicated in appetite and substrate metabolism in humans. We tested the hypothesis that increasing the calcium content of a meal would enhance GIP_{1-42} and GLP-1 concentrations in humans and aimed to determine the subsequent impact on insulinemia, appetite, and substrate metabolism. Ten healthy males consumed two macronutrient-matched meals in a randomized, crossover design. The control meal contained 3 mg/kg body mass of calcium, which was increased to 15 mg/kg body mass in the high-calcium meal. Circulating concentrations of GIP_{1-42}, GLP-1, and insulin were determined over a 180-min postprandial period, followed by 60 min of exercise. Visual analogue scales were used to determine subjective appetite sensations. Rates of energy expenditure and substrate (fat and carbohydrate) oxidation were estimated using indirect calorimetry. The high-calcium meal potentiated the 120-min postprandial GIP_{1-42}, GLP-1, and insulin concentrations by 47%, 22%, and 19%, respectively (all $p < .05$). Appetite was suppressed for the first 60 min postprandially in the high-calcium trial ($p < .05$). No significant differences were detected in substrate oxidation at rest or during exercise (all $p > 0.05$). Consuming a high-calcium meal transiently enhances the postprandial responses of circulating GIP_{1-42} and GLP-1 in humans. The increase in these gastrointestinal hormones may underlie the greater insulinemia and appetite suppression following the high-calcium meal.

Thermic effect of a meal: A comparison of maltodextrin and protein isocaloric meal-replacement shakes

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The role of macronutrients in dietary supplements for athletes has been widely studied. Less is known about the effect of maltodextrin on energy expenditure in the postprandial period. The study compares the thermic effect of a meal (TEM) at rest after ingestion of high-maltodextrin (MALT) and high-protein (PRO) meals. Seventeen male subjects (24 ± 3 years, BMI 25.5 ± 3.1 kg/m^2) completed the crossover, single-blind study. During two separate occasions, held on nonconsecutive days, baseline resting metabolic rate and TEM were established by indirect calorimetry using breath-by-breath system of recording (Cortex MetaLyzer 3B device). Before and after administration of testing meals, CO_2 and O_2 were recorded for each subject. Two isocaloric liquid meals (M 501 ± 51 kcal) consisting of 100% maltodextrin and 85% protein (blend of milk, whey, and egg fraction) were individualized according to the fat free mass (FFM; 7 kcal/kg/FFM). The TEM was measured intermittently for 180 min. Nonparametric statistics was used and the value of $p \leq .05$ was accepted as the limit of significance. An immediate and persisting thermic effect was caused by the test meals. The increment of energy expenditure did not return to the baseline after 3 hr in either MALT or PRO experiment. The TEM calculated in PRO was significantly higher in comparison with MALT both in absolute (64.6 ± 26.2 and 34.8 ± 17.7 kcal/180 min, respectively) and relative values when matched for FFM (1.30 ± 1.11 and 0.48 ± 0.23 kcal/kg FFM/180 min, respectively; $p <$ .01). The TEM, expressed as percentage of energy consumed, averaged 6.9% ± 3.5% for the MALT meal, compared to 12.9% ± 2.2% for the PRO meal ($p < .01$). It is concluded that thermic effect of maltodextrin is comparable with the values generally identified for carbohydrates. Energy expenditure above the baseline after ingestion of protein test meal is approximately twofold higher compared to the maltodextrin test meal.

Energy availability in female endurance athletes and the impact on energy and bone metabolism, health, and recovery after exercise. Preliminary results from an ongoing study

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Energy availability (EA) in female athletes is a nutritional concern linked to reproductive function and bone health. The aim of this ongoing study was to investigate if subjects with

insufficient EA differ with regards to energy and bone metabolism, reproductive function, recovery, injuries, and markers of vascular risk factors compared to subjects with sufficient EA. Fifty female athletes (18–39 years), training ≥5 times/week are being recruited from weight-bearing endurance-sport federations and competitive clubs. Protocol includes gynecological examination and analyses of sex hormones to clinically verify reproductive health; DXA and bone markers for assessment of bone health; blood samples for analyses of lipids, hormones, iron, and vitamin D status; indirect respiratory calorimetry to measure RMR, VO_{2peak}, and work efficiency; two maximal incremental tests with a 4-hr interval to assess ability to recover from exercise; and assessment of eating disorders using Eating Disorder Examination. Accelerometers (ActiGraph) and heart rate (Polar) during 7 consecutive days for assessment of total energy expenditure, exercise energy expenditure, and NEAT combined with assessment of energy intake. Preliminary data on the first 25 subjects (median [Q25–Q75]); 28 [22–32] years, BMI 20.2 [19.2–21.3] kg/m^2, exercising 9.9 [8.6–12.3] hr/week). Twenty subjects (80%) had insufficient EA. Five (20%) were diagnosed with eating disorders (1 bulimia nervosa, 4 EDNOS). Twelve (48%) were diagnosed with amenorrhea, 10 (40%) osteopenia, 2 osteoporosis, and 6 (24%) had increased LDL and hypercholesterolemia. Preliminary results indicate that despite a normal BMI range in this group of female endurance athletes, there is a high prevalence of insufficient EA according to our assessment, as well as clinical disorders found to be linked to impaired health, such as eating disorders, menstrual dysfunctions, osteopenia/osteoporosis, and hypercholesterolemia.

Effect of galactose ingestion before and during exercise on substrate oxidation and subsequent energy intake in females

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Consuming meals based on low-glycemic-index (GI) carbohydrates before moderate-intensity exercise results in increased fat oxidation during, and suppressed appetite following, exercise. It is not clear whether such responses are evident when carbohydrate is consumed in a beverage form. The purpose of this study was to investigate the effects of consuming a carbohydrate drink on substrate oxidation, postexercise satiety, and subsequent energy intake. Nine recreationally active eumenorrheic females ($M \pm SD$ age, weight, and VO_2peak 22 ± 3 years, 63.3 ± 7.6 kg, and 50.7 ± 7.0 ml/kg/min, respectively) undertook three trials, each consisting of running for 60 min at 65% VO_{2peak} followed immediately by a 90-min rest period. Prior to (300 ml) and at every 15 min during exercise (150 ml), participants consumed either a glucose (GLU: GI~89) or galactose (GAL: GI~20) drink each containing 45 g of carbohydrate or an artificially sweetened placebo (PLA). Following the rest period, participants were provided with an ad libitum test lunch and asked to record food intake for the remainder of the day. Plasma glucose was significantly greater throughout exercise and rest following the GLU trial compared with the GAL and PLA trials ($p < .05$), but there were no differences in carbohydrate oxidation. Hunger was significantly lower ($p < .05$) throughout the GAL compared to the GLU and PLA trials. Overall net energy balance was negative in both the GAL ($p < .05$ vs. GLU) and PLA trials. Results demonstrate that ingesting a solution containing galactose before and during exercise can positively affect postexercise satiety and energy balance throughout the day, compared to a more readily available and widely consumed form of carbohydrate. In addition, carbohydrate utilization during exercise was not affected.

Oxidative stress and capacity after 3 weeks of strenuous exercise in young adults

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Strenuous exercise increases the production of reactive oxygen species (ROS), and athletes have an up-regulated antioxidative capacity (AO) compared to sedentary subjects. We tested the hypothesis that AO is up-regulated even after a short period of strenuous endurance training. Fourteen healthy 26-year-old (median) volunteers participated in 3 weeks intense training with 2 sessions per day, 6 days a week, intensity targeted to 75% of VO_{2max}. After the last training session, all baseline measurements were repeated. Thereafter, participants were asked to refrain from any sport activity during a subsequent 4-week postexercise recovery period. Finally, at the end of the recovery period investigations were performed again. The level of oxidative stress did not change significantly over 3 weeks of training or after 4 weeks of recovery. The total plasma AO levels decreased significantly during the 3 weeks of exercise compared to baseline. After 4 weeks of recovery, the levels had increased but were still lower than baseline. At baseline oxidative stress was inversely related to fat free mass ($r = –.65$, $p = .01$), hemoglobin ($r = –.89$, $p < .001$), leukocyte count ($r = –.66$, $p = .01$), oxygen uptake ($r = –.55$, $p = .04$), and directly to respiratory quotient ($r = .68$, $p = .007$). AO correlated to neither. C-reactive protein ($r = .64$, $p = .02$) and the respiratory quotient ($r = .59$, $p = .03$) were directly related to the relative amount of body fat, while oxidative stress and AO were not. Oxygen uptake increased, but body fat was not altered during the exercise period, nor was oxidative stress. However, AO decreased ($p = .004$) as did hemoglobin ($p = .006$). While oxygen uptake increases with a short period of strenuous exercise, body fat seems unaltered and AO may decrease rather than increase. Whether reduction of AO is due to limited availability or consumption from exercise-induced ROS remains to be proven.

Effects of caffeine drinks on endurance performance, fluid balance, and subjective feelings

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The use of energy drinks before an acute exercise among recreational athletes has been observed to increase in order to enhance well-being. This study compared the acute effect of energy drinks on fluid balance and subjective feelings during endurance exercise. Healthy adults (N = 10, 5 men, 5 women; 26 ± 8 years) completed four endurance exercises (randomized, crossover) in warm 22°C temperature while ingesting 25 min before each trial one service (0.33 L) of (a) high-carbohydrate (CHO, 33 g) energy drink with 106 mg caffeine (HCHO), (b) low-CHO (10 g) energy drink with 106 mg caffeine (LCHO), (c) low-CHO noncaffeine drink (NCAF), or (d) water (WAT). Trials were separated by 7 days. Endurance exercise included 60 min cycling at 60% of VO_{2max} (SUBMAX) and then an incremental test to exhaustion (MAX). Blood samples for lactate, glucose, osmolality, Na^+, Cl^-, and K^+ were drawn before drink and immediately before and after SUBMAX. Urine Na^+, K^+, and osmolality were also analyzed. Food ingestion was standardized 16 hr before each trial. Heart rate, rate of perceived exertion, and blood lactate increased during SUBMAX, but there were no significant differences between the trials. In addition, all trials induced a similar increase in serum osmolality and Na^+, K^+, and Cl^- concentrations and decrease in urine osmolality and Na^+ concentration. Urine K^+ remained the same. Furthermore, there were no differences between the trials in MAX time to exhaustion (LCHO 7:34 ± 1:53, NCAF 7:08 ± 1:19, HCHO 8:07 ± 2:33, WAT 6:57 ± 1:36 min:s; $p > .05$) and changes in body weight and plasma volume. However, thirst ($p < .05$) and plasma glucose ($p < .001$) had a significant exercise × trial interaction increasing first after ingestion HCHO and LCHO and decreasing in the middle of SUBMAX. In conclusion, caffeinated energy drink with high- or low-carbohydrate and noncaffeine or pure water before an acute endurance exercise had similar effects on fluid balance and subjective feelings and endurance performance.

Does immediate carbohydrate intake following glycogen-depleting exercise affect next day's 5000 m time trial performance?

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Athletes are often required to perform two bouts of exhausting exercise within 24 hr. Immediate carbohydrate ingestion at rates of ≥ 1.2 g/kg/hr is recommended to promote recovery of glycogen stores. However, whether this nutrition strategy affects performance in runners remains unknown. The purpose of the study was to investigate the effect of immediate carbohydrate intake following glycogen-depleting exercise on next-day 5,000-m time-trial performance. Twelve recreational runners were included (4m/8w; 1.73 ± 0.11 m, 69.1 ± 13.4 kg). Athletes performed a baseline 5,000-m time trial (bTT) and twice a glycogen-depleting exercise (60 min at 75% of HR_{max}) followed by immediate intake of either 1.5g/kg/hr carbohydrates (CARB) during the first 3 hr postexercise or placebo (PLA, ≤0.3g/kg/hr carbohydrates). Postintervention 5,000-m time trials were performed 24 hr after CARB and PLA, respectively. The diet (CARB vs. PLA) was randomly allocated. Time-trial running time served as outcome measure, and ratings of perceived exertion (RPE using Borg's scale), blood lactate concentration (bLa), and heart rate (HR) were additionally assessed immediately following time trials. Data (M ± SD) were analyzed using repeated-measures ANOVA (α = .05). Running time during 5,000-m time trials did not differ between bTT (1,305 ± 140 s), following CARB (1,276 ± 125 s) or PLA (1,285 ± 124 s, p = .85). There were no differences in RPE (bTT 18.3 ± 0.3, CARB 18.7 ± 0.3, PLA 18.8 ± 0.9; p = .48), bLa/min, PLA 187 ± 3 beats/min; p = .96). Preliminary data suggest that immediate carbohydrate intake at rates of 1.5g/kg/hr following glycogen-depleting exercise does not affect next-day 5,000-m running performance or physiological parameters and subjective exertion compared to placebo. Thus, the rationale of recommending immediate carbohydrate intake following exhausting exercise to 5,000-m runners might be questioned.

Effect of hypotonic and hypertonic glucose-electrolyte drinks on gastric emptying and drink retention after exercise in the heat

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This study examined the gastric emptying and rehydration effects of hypotonic and hypertonic glucose-electrolyte drinks after exercise-induced dehydration. Eight healthy males (24 ± 3 years, 79.5 ± 9.3 kg, 1.80 ± 0.08 m) lost 1.78% ± 0.11% of their initial body mass by intermittent cycling in the heat and rehydrated with 150% of body mass loss with a hypotonic 2% (193 ± 2 mOsm/kg; 2% trial) or a hypertonic 10% (656 ± 3 mOsm/kg; 10% trial) glucose-electrolyte drink over 60 min. Blood and urine samples were taken preexercise, postexercise, and 60, 120, 180, and 240 min postexercise. Gastric and test drink volume were determined 15, 30, 45, 60, 90, and 120 min postexercise. At the end of the gastric sampling period 0.3% ± 0.2% (2% trial) and 42.1% ± 6.6% (10% trial; $p < .001$) of the drink remained in the stomach. Plasma volume was lower ($p < .01$) and serum osmolality greater ($p < .001$) at 60 and 120 min during the 10% trial. At 240 min, cumulative urine volume was greater during the 2% trial (1,025 ± 219 ml) compared to the 10% trial (746 ± 210 ml; $p < .01$), and consequently total drink retention over the study period was greater ($p < .001$) during the 10% trial (64% ± 11%) than during the 2% trial (52% ± 10%). Whole-body net fluid balance was greater from 120 min during the 10% trial ($p < .001$), but when net fluid balance was corrected for the volume of drink remaining in the stomach, it

was greater at 60 and 120 min during the 2% trial ($p < .001$). These results suggest that the reduced urine volume following ingestion of a hypertonic rehydration drink might be mediated by a slower rate of gastric emptying, which delays the recovery of plasma volume and attenuates the decline in serum osmolality after drinking. The slow rate of gastric emptying of such solutions, however, makes rehydration efficiency difficult to determine in the hours immediately after drinking, compromising the calculation of whole-body fluid balance.

Sweat rates and fluid intakes of Olympic-standard divers in training

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Very little data on fluid balance in elite divers exist, so the purpose of this study was to investigate fluid intake and sweat rates in Olympic-standard divers during a training session. Thirteen divers (6 men, 7 women) who had either competed at an Olympic Games or had qualified for the 2008 Beijing Olympics participated in this study. Sweat rates were measured by changes in body mass and corrected for fluid ingestion and urine output. This equation does not take into account substrate oxidation and respiratory losses thus, the limitations of this method are acknowledged. The training session lasted 145 min, where 65 min was conducted on dry land (air temp. 21.2°C) and 80 min in the pool (air temp. 35.4°C, water temp. 26.1°C). Mean urine osmolality pretraining was 436 ± 174 mOsmol/kg. Total mean sweat volume loss during the training session was 0.52 ± 0.08 L and 0.60 ± 0.11 L of fluid was ingested. Sweat rates in the pool were higher than in dry land (0.24 ± 0.07 vs. 0.18 ± 0.04 L/h, $p < .001$), but there were no differences in either sweat rates or fluid consumed between men and women divers. Total mean sweat rates for the training session was 0.22 ± 0.3 L/h. Sweat rates in Olympic-standard divers are similar to those reported for other aquatic athletes such as swimmers and water polo players. The divers in this study remained hydrated and some even ingested more fluid than required.

Effect of the addition of protein to carbohydrate-electrolyte drinks on postexercise rehydration

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Carbohydrate-electrolyte (CE) drinks have been shown to be useful in postexercise rehydration. Recently, milk or CE drinks plus milk protein have been suggested to be more effective in rehydration than CE drinks. Milk protein contains whey and casein protein; however, it is not clear whether the different properties of these two proteins will result in different effects on postexercise rehydration. We examined the effects of the addition of whey or casein protein to CE drinks on postexercise rehydration. Ten males (age 21 ± 1 years, body weight 65.4 ± 6.3 kg, VO_{2max} 60.7 ± 6.1 ml/kg/min) ran for 60 min at 65% VO_{2max} on three occasions in a randomized crossover study design, separated by at least 7 days. During a 4-hr recovery, the subjects consumed either a volume of a CE beverage, CE+whey protein (CW) beverage, or CE+casein protein (CC) beverage equal to 150% of the body weight loss during previous run. The beverages were matched for energy density (264 kcal/L) and electrolytes content (Na 14 mmol/L; K 3.3 mmol/L) and were consumed in six equal volumes at 30-min intervals during recovery. Blood samples and urine samples were collected before exercise and during recovery. After exercise, subjects lost ~2.3% of their preexercise body weight in all trials. Total urine output after recovery was greater in CE and CC trials than that in CW trial (CW vs. CE & CC: 1,005 ± 214 vs. 1,184 ± 378 & 1,256 ± 413 ml, $p < .05$). The total fluid retention was greater after ingestion of CW than CE and CC drinks (CW vs. CE & CC: 54.9% ± 9.2% vs. 46.9% ± 16.5% & 45.8% ± 17.3% ml, $p < .05$). A lower urine specific gravity (USG) value was found by the second hour in CC trial ($p < .05$) and third hour in CE trial ($p < .05$) compared with CW trial respectively. No difference was found in the changes of plasma volume among the three trials. During a 4-hr recovery after the 60-min run, the CW solution is more effective for rehydration than the CE or CC solution.

Effect of carbohydrate only and carbohydrate plus caffeine co-ingestion on a battery of reliable soccer-specific tests

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The aim of this study was to investigate the effect of co-ingesting carbohydrate plus caffeine (CHO+CAFF) in comparison to carbohydrate only (CHO) and a placebo (PLA) during a battery of reliable soccer-specific tests. Twelve male university-standard soccer players ingested a PLA, a 32-g CHO and 32-g CHO plus 300-mg CAFF solution on three separate occasions, in a randomized crossover design separated by 7 days. The testing battery consisted of five tests, which included four countermovement jumps, two repetitions of the pro-agility test, three repetitions of the 30-m linear sprint test, 1 repetition of the short repetitive sprint test, and the Yo-Yo Intermittent Recovery Level 2 Test. CHO+CAFF improved acceleration compared to CHO and PLA trials (CHO+CAFF, 1.70 ± 0.09 m/s^2; CHO, 1.81 ± 0.08 m/s^2; PLA, 1.76 ± 0.07 m/s^2, $p = .016$). CHO+CAFF also enhanced maximal velocity (CHO+CAFF, 2.60 ± 0.11 m/s; CHO, 2.67 ± 0.10 m/s; PLA, 2.69 ± 0.08 m/s, $p = .010$) and fastest 20-m sprint speed (CHO+CAFF, 3.28 ± 0.08 s; CHO, 3.36 ± 0.10 s; PLA, 3.41 ± 0.11 s, $p = .009$) compared to the CHO and PLA. Speed-endurance was enhanced in CHO+CAFF (41.05 ± 0.95 s, $p = .037$) and CHO conditions (42.17 ± 1.00 s, $p = .047$) but not in the PLA (42.22 ± 1.43 s, $p > .05$). RPE was also lower during the short repetitive sprint test in CHO+CAFF (13.58 ± 1.16, $p = .0001$) compared to CHO (14.67 ± 1.15, $p > .05$) and PLA (14.92 ± 1.00, $p > .05$). No differences were found during the countermovement jumps, pro-agility test, distance covered during the Yo-Yo IR2 test, blood lactate, and performance decrement during the short repetitive sprint test across all trial conditions. These data suggest that CHO+CAFF co-ingestion 45 min before testing can enhance some aspects of soccer-related fitness including acceleration, maximal velocity,

20-m sprint speed, speed-endurance, and lower RPE during repetitive sprints compared with CHO-only and PLA beverages.

The utility of hydration markers to identify mild hypertonic and isotonic hypohydration

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The study aim was to assess the utility of common hydration markers to identify mild hypertonic and isotonic hypohydration. Fifteen males completed three randomized 48-hr trials, where energy intake was standardized throughout. On day 1, participants completed a hydration assessment followed by high-intensity aerobic exercise. After exercise, they began one of three trials. On the control trial (CON) participants consumed adequate fluid to maintain euhydration. On the isotonic hypohydration trial (IH) participants ingested the same fluid as on CON, but at 0800 hr on day 3 they consumed 0.65 mg/kg of the diuretic furosemide. On the hypertonic hypohydration trial (HH), drinking fluids were restricted to 2ml/kg/day for 48 hr after the exercise on day 1. After 48 hr, the participants completed a second hydration assessment. Dehydration on HH and IH was equal to 1.9% and 2.0% of body mass, respectively. Urinary markers showed the best utility to identify mild hypertonic hypohydration (Ucol: 2 ± 1, 6 ± 1, 2 ± 1; Usg: 1.008 ± 0.004, 1.028 ± 0.005, 1.011 ± 0.004; Uosm: 260 ± 136, 1043 ± 130, 404 ± 106, CON, HH, and IH, respectively; HH vs CON effect sizes: d = 5.6, 4.4, 5.6, Ucol, Usg, and Uosm, respectively), while plasma osmolality (Posm), saliva osmolality (Sosm), and saliva flow rate (Sfr) showed moderate utility (Posm: 286 ± 4, 296 ± 6, 286 ± 4; Sosm: 55 ± 13, 65 ± 12, 56 ± 12; Sfr: 380 ± 240, 212 ± 173, 431 ± 310, CON, HH, and IH, respectively; HH vs CON effect sizes: d = 1.8, 0.7, 0.8, Posm, Sosm, and Sfr, respectively). Isotonic dehydration was poorly identified by most hydration markers, with the exception of heart rate change (LSΔHR) from lying to standing (LSΔHR: 14 ± 8, 19 ± 10, 26 ± 12, CON, HH, and IH, respectively; HH vs CON effect size: d = 0.6). Hydration marker utility is dependent on the type of hypohydration. These results highlight how some commonly used hydration markers may misdiagnose athletes and patients.

Endurance performance in a temperate environment after mild hypertonic and isotonic hypohydration

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The study aim was to examine the effects of mild hypertonic and isotonic hypohydration on endurance performance. Fifteen males completed three randomized 48-hr trials, where energy intake was standardized throughout. On day 1 participants completed a time to exhaustion (TTE1) after which they began one of three trials. On the control trial (CON) participants consumed adequate fluid to maintain euhydration. On the isotonic hypohydration trial (IH), participants consumed the same fluid as on CON, but at 0800 hr on day 3 they consumed 0.65 mg/kg of the diuretic furosemide. On the hypertonic hypohydration trial (HH), drinking fluids were restricted to 2 ml/kg/day for 48 hr. After 48 hr, the participants completed a second time to exhaustion (TTE2). Hydration and perceptual measures were assessed before each TTE, and thermoregulatory, cardiovascular, and perceptual measures were obtained during exercise. Before TTE2, dehydration on HH and IH was 1.9% and 2.0% of body mass, respectively. Plasma osmolality was higher on HD compared with CON and IH (286 ± 4, 296 ± 6, 286 ± 4; CON, HH, and IH, respectively; $p < .01$ vs. CON and IH) and plasma volume loss was only observed on IH (1.7 ± 6, –0.3 ± 6, –6.6 ± 4; CON, HH, and IH, respectively; $p < .01$ vs. CON and HH). Compared with CON endurance performance in TTE2 was reduced by 30% after HH ($p < .05$, d = 1.3) and 39% after IH ($p < .01$, d = 1.9). During TTE2, mean perceived exertion was greater in both HH and IH ($p < .01$ vs. CON). The reduction in endurance performance after HH was probably caused by differences in mood (vigor decreased 32% and fatigue increased 85%) and perceptual comfort (thirst increased 100%). The addition of cardiovascular strain is tentatively suggested as the cause for the greater reduction in endurance performance after IH (stroke volume decreased 7%). Isotonic hypohydration causes a greater reduction in endurance performance than hypertonic hypohydration evoked by prolonged fluid restriction.

Estimating body composition in elite rugby union athletes using surface anthropometry

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Body composition monitoring is routinely performed in elite athlete populations due to its well-reported relationship to competitive success. Due to its low cost, portability, and practicality, surface anthropometry is the preferred method of body composition measurement in the field. However, the validity of generic equations for estimating body composition from anthropometric data has been questioned. The present study aims to compare available "skinfold equation" derived data against dual-energy X-ray absorptiometry (DXA) data on a group of international rugby union athletes. Between 2009 and 2012 surface anthropometry (SA) data were collected multiple times on 75 professional rugby union athletes (average age 25 years, range 19–36 year; average weight 103 kg, range 80–123 kg) according to International Society for the Advancement of Kinanthropometry (ISAK) standards, by a single experienced anthropometrist, using a standardized protocol. Body mass and skinfold measurements from seven ISAK-recognized sites were collected. When SA data were collected, a DXA scan (providing measures of total mass, fat mass, lean mass, and fat free mass) was also undertaken within 7 days of the SA. The skinfold data were used to predict percentage body fat (%BF) using equations specific to males derived using Harpenden calipers and sites specified by ISAK, and compared to the corresponding DXA-generated %BF. Statistical analysis was undertaken using the Bland–Altman method for assessing agreement between two methods of measurement taking into account multiple observa-

tions per individual. Data analysis revealed moderate to high levels of bias, and/or trend, and/or variability in all the equations tested, indicating no currently available skinfold equation provides a reliable and repeatable estimate of %BF using SA compared to DXA in this population.

Short-term fructose consumption attenuates exercise-induced increases in nuclease accessibility to the MEF2 *cis* element on the GLUT4 promoter and GLUT4 expression in rat skeletal muscle

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Several studies have shown that skeletal-muscle GLUT4 expression is increased by exercise and decreased by high fructose consumption. While it is known that exercise enhances GLUT4 expression via increased binding of MEF2A to the GLUT4 promoter, the mechanism responsible for, and the impact of fructose consumption on, this interaction have not been studied. This study tested the hypothesis that both excess fructose and exercise alter the accessibility of the MEF2 binding element on the GLUT4 promoter by remodeling chromatin in the region**.** Male rats (N = 30) were fed (a) standard chow, (b) chow + 10% fructose drink, and (c) chow + 10% maltodextrin drink. All rats had access to water and chow ad libitum for a period of 13 days. In the last 6 days of the experiment 5 animals in each group performed 3 × 17-min bouts of intermittent swimming daily and the remaining 5 remained unexercised. Triceps muscles were harvested and used (a) for measurement of GLUT4 content by Western blot, (b) to obtain intact nuclei for assessment of the accessibility of the DNA region surrounding the MEF2 element by nuclease accessibility assays, and (c) to measure the acetylation state of histones and bound MEF2A at the region by ChIP assays. Serum glucose, insulin, and free fatty acids were also assayed. Fructose did not alter GLUT4 content in untrained rats but blocked the increase (~70%; $p < .05$) that occurred due to swimming. Accessibility of the region surrounding the MEF2 element by both MNase and DNase I was significantly increased (~2-fold) by swimming only in rats that did not consume fructose. MEF2 binding and GLUT4 expression paralleled the accessibility pattern. Maltodextrin had similar effects as fructose. The mechanism by which fructose blocked chromatin remodeling that occurs in response to swimming is not known but may reflect differences in caloric intake or muscle fatty-acid content. These effects are not unique to fructose.

Prehydration requirements of working dogs

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Detection dogs work in adverse environments. In the field, dog handlers have used subcutaneous fluids and oral electrolyte solutions in addition to water to prevent dehydration; however, the efficacy of these strategies is unknown. This field study evaluated the effects of three prehydration strategies on body weight, blood electrolytes, and search performance in 3 police canines working in hot environments using a crossover design. Each dog was randomly assigned to 10 ml/kg of water (W), subcutaneous balanced electrolyte solution (SQ), or oral electrolyte solution (OES) at the beginning of each workday. All dogs were offered water every 30 min; however, OES dogs were offered 10 ml/kg OES if they drank <3 ml/kg of water. At the beginning, middle, and end of each day, body weight, serum electrolytes, lactate, and vital signs were measured. A timed standardized search at the beginning and end of each day was conducted. Dogs in the W (n = 3) and SQ (n = 3) groups drank a combined mean of 5.0 ml/kg/hr, whereas the OES dogs (n = 3) drank 18.6 ml/kg/hr. Only dogs in the OES group developed isosthenuria and gained weight. Hematocrit decreased by the end of the workday for dogs in the OES and SQ groups. Regardless of the hydration strategy, all dogs had a small but significant decrease in potassium; no hydration strategy resulted in a significant change in electrolyte values throughout the day. Only dogs in the OES group maintained blood bicarbonate concentrations and had faster afternoon search times compared to the morning.

Repeated familiarization with hypohydration attenuates the decrement in running performance caused by hypohydration

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Starting exercise hypohydrated has been shown to impair exercise performance, but in these studies subjects have not been familiarized with the protocol used to induce hypohydration. The aim of this study was to determine the effects of repeated familiarization with hypohydration on euhydrated and hypohydrated performance in a 5-km treadmill time trial. After familiarization with the exercise protocol, 10 recreationally active males completed a euhydrated (EU-pre) and hypohydrated (HYPO-pre) trial, involving a 45-min run at 75% VO_{2peak} (45SS) followed by a 5-km treadmill time trial (TT). Euhydration/Hypohydration were induced by manipulating fluid intake in the 24 hr preexercise and during 45SS. Subjects then completed four habituation sessions involving replication of HYPO-pre, with the exception that they completed 60 min running at 75% VO_{2peak} and no TT. Subjects then replicated the euhydrated (EU-post) and hypohydrated (HYPO-post) trials. Body mass loss at the start of TT was 0.2% ± 0.2% (EU-pre), 2.4% ± 0.3% (HYPO-pre), 0.1% ± 0.1% (EU-post), and 2.4% ± 0.3% (HYPO-post). TT performance was 5.8% ± 2.4% slower during HYPO-pre (1,459 ± 250 s) than EU-pre (1,381 ± 237 s; $p < .01$), but only 1.2% ± 1.6% slower during HYPO-post (1,381 ± 200 s) than EU-post (1,366 ± 211 s; $p = .064$). TT performance was not different between EU-pre and EU-post ($p > .05$, mean CV = 0.7%), but was 5.1 ± 2.3% faster during HYPO-post than HYPO-pre ($p < .01$). Heart rate was greater during HYPO than EU trials ($p < .001$), while RPE showed a similar response to TT time and was lower in HYPO-post compared to HYPO-pre ($p < .01$). In conclusion, hypohydration impaired 5-km running performance in subjects unfamiliar with the hypohydration protocol, but four familiarization sessions designed to habituate subjects with the hypohydration protocol

attenuated the performance decrement, seemingly via an attenuation of RPE during hypohydration.

Whey protein addition to a carbohydrate-electrolyte drink does not influence postexercise rehydration

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The purpose of this study was to examine whether the addition of whey protein concentrate to a carbohydrate-electrolyte drink ingested after exercise-induced dehydration affects subsequent rehydration. Sixteen (13 male, 3 female) subjects (*M* ± *SD* age 24 ± 5 years, height 1.75 ± 0.08 m, body mass 76.73 ± 13.83 kg) lost 1.91% ± 0.11% of their initial body mass via intermittent exercise in a hot environment (35°C, 60% relative humidity). Subjects then rehydrated with 150% of their body mass loss over 1 hr, with either a carbohydrate (C; 30 g/L glucose, 30 g/L maltodextrin, 25 mmol/L NaCl) or carbohydrate-protein (CP; 30 g/L glucose, 30 g/L maltodextrin, 20 g/L whey protein concentrate, 25 mmol/L NaCl) drink. After drinking, subjects rested in the laboratory for 4 hr. Urine and blood samples were taken preexercise, postexercise, postdrinking, and 1 hr, 2 hr, 3 hr, and 4 hr postdrinking. Total cumulative urine output after rehydration w as not different between trials (C 1,057 ± 319 ml and CP 970 ± 334 ml, $p = .209$) and consequently drink retention during the study was also not different between trials (C 51% ± 12% and CP 55% ± 15%, $p = .195$). At the end of the study, net fluid balance was significantly negative compared to baseline for C (–393 ± 272 ml) and CP (–307 ± 331 ml; p .157). These results suggest that the addition of whey protein concentrate to a carbohydrate-electrolyte rehydration drink neither enhances nor inhibits postexercise rehydration. These findings indicate that in situations where the ingestion of protein after exercise might infer some benefit for postexercise recovery, whey protein concentrate could be added to a rehydration solution without interfering with the rehydration process.

The effect of rehydration after dehydrating exercise in the heat on appetite and energy intake

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This study examined the appetite response to postexercise rehydration compared to no rehydration. Ten males lost 1.9% ± 0.1% of their preexercise body mass by intermittent cycling in the heat (35 ± 0.3°C, 78% ± 3% relative humidity) in the afternoon, on two separate occasions. They then left the lab, returning the following morning 13 hr later. Over this 13 hr, subjects were either rehydrated (RE) or remained hypohydrated (HYPO), eating a snack ~1 hr postexercise and an evening meal ~2.5 hr postexercise. During the RE trial subjects drank water equal to 175% of their body mass loss (1 L for every 1-kg loss) during the 13 h (30% postexercise, 25% 2.5 hr postexercise, 20% before bed, 25% 11 hr postexercise). During HYPO, 200 ml water was drunk. Urine and blood samples, and subjective feelings questionnaires were collected pre-, post-, and 13 hr postexercise, with an ad libitum breakfast meal provided 13 hr postexercise. Thirteen hours postexercise, body mass loss was 2.7% ± 0.5% (HYPO) and 0.5% ± 0.5% (RE). Total energy intake from food and fluid at the ad libitum meal was not different between RE (4,237 ± 1,459 kJ) and HYPO (4,612 ± 1,487 kJ; $p = .44$), while energy intake from fluids was also not different between RE (1,217 ± 864 kJ) and HYPO (709 ± 752 kJ; $p = .15$). Total water ingested in foods and fluids at the ad libitum meal was greater for HYPO (1,641 ± 367 ml) than RE (797 ± 275 ml; $p < .001$), caused by a greater water intake from fluids ($p < .001$), but not foods ($p = .45$). This meant that subjects ingested enough water to replace 69% of their fluid loss in HYPO (estimated from body mass changes). Thirteen hours postexercise, subjects rated their feelings of thirst greater ($p < .001$) and fullness lower ($p < .01$) during HYPO compared to RE. These results demonstrate that inadequate postexercise rehydration does not influence energy intake from an ad libitum meal consumed 13 hr postexercise, despite reduced subjective feelings of fullness.

Effects of dietary nitrate supplementation on a battery of reliable soccer-specific tests

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Dietary nitrate supplementation has been found to lower the oxygen cost of submaximal exercise, increase time to exhaustion, and enhance performance in time trials. The effect of nitrate supplementation on soccer-specific performance is unknown, so the purpose of this study was to investigate the effects of dietary nitrates on a battery of reliable soccer-specific tests commonly used in professional soccer. Fourteen well-trained soccer players (stature, 1.75 ± 0.06 m; body mass, 74.8 ± 5.6 kg; sum of 7 skinfolds, 51.2 ± 10.2 mm) who trained for at least 10 hours per week participated in this study. In a randomized single-blind crossover design players consumed either 140 ml/day of concentrated beetroot juice or a placebo daily for 3 days prior and 90 min before completing a battery of commonly used reliable soccer-specific tests separated by a 7-day washout. The test battery consisted of the pro-agility test, 10-m and 30-m sprints, a countermovement jump, the Yo-Yo Intermittent Recovery Level 2 Test, and blood lactate was taken within 2 min of finishing the Yo-Yo test. No changes in performance were observed in the concentrated beetroot juice vs. placebo on the pro-agility test (5.54 ± 0.42 vs. 5.47 ± 0.37 s, $p > .05$), 10-m (1.68 ± 0.11 vs. 1.71 ± 0.09 s, $p > .05$) and 30-m sprints (4.28 ± 0.19 vs. 4.32 ± .021 s, $p > .05$), and countermovement jumps (34.49 ± 10.35 vs. 36.41 ± 5.26, $p >$ .05). Distance covered during the Yo-Yo Intermittent Recovery Level 2 Test was greater in the beetroot condition compared to the placebo (698 ± 115 vs. 684 ± 109 m, $p < .007$), but no changes in blood lactate measured at the end of the Yo-Yo test were observed (10.8 ± 2.1 vs. 11.0 ± 2.2 mmol/L, $p > .05$). These data suggest that ingesting 140 ml/day of concentrated beetroot juice for 3 days and 90 min prior to testing can increase the distance covered on the Yo-Yo Intermittent Recovery Level 2 Test by 1.9%.

High-intensity interval training every second week maintains VO_{2max} in soccer players

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The amount of endurance exercise training among semiprofessional soccer players is reduced during the active recovery period between the end of the competition season and start of the preparatory period. Deconditioning before the preparatory period starts can have negative effects as the players have to put in a lot of effort to reach optimal in-season aerobic fitness levels. In the present study we investigated the effect of a 6-week period with one high-intensity aerobic training session (HIT) per week and one HIT every second week on maintenance of aerobic fitness among semiprofessional soccer players. Seventeen male players from the third-highest soccer division in Norway volunteered to participate in this study that took place in the teams' off-season (November to January). The subjects were randomized into one of two groups, either training one HIT per week (Group 1; $n = 9$) or one HIT every second week (Group 0.5; $n = 8$). The training session consisted of five bouts of 4 min running at 87–97% of age-predicted maximum heart rate. A 20-m shuttle-run test and VO_{2max} test on a treadmill were performed by all subjects before and after the training intervention. Before the training intervention, distance covered during the 20-m shuttle-run test and VO_{2max} on treadmill were not different between the groups. After 6 weeks of training, distance covered during the 20-m shuttle run was 8% ± 6% lower ($p < .01$) for Group 1, nonsignificantly 5% ± 10% lower for Group 0.5, and 6% ± 8)% lower when groups were pooled ($p < .01$). There was no change in VO_{2max} in either of the groups. In conclusion, training one HIT every second week is sufficient for maintaining VO_2 during a short active recovery period for semiprofessional soccer players. However, performance in a soccer-specific fitness test was slightly reduced.

The influence of different sources of polyphenols on submaximal cycling and time trial performance

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The primary purpose of the study was to establish the effects of commercially available polyphenol-rich antioxidant supplements, Pycnogenol® with added bioflavonoids (PYC-B) compared to CherryActive (CHA), on 20-km cycling performance. Using a double-blind counterbalanced, repeated-measures design, - male cyclists or triathletes (32.1 ± 11.2 years; VO_{2max} 4.2 ± 0.7 L/min; maximal power output 391.7 ± 39.5 W) consumed 200 mg of CHA, 120 mg of PYC-B, or 200 mg of placebo (PLA) capsules, 2 days before and on the day of each experimental trial. The experimental trials consisted of four 5-min stages at 40%, 50%, 60%, and 70% maximal power output (W_{max}), followed by a 20-km time trial (TT). A two-way repeated-measures ANOVA revealed no significant differences between trials for heart rate (HR), respiratory exchange ratio (RER), gross mechanical efficiency (GME), oxygen consumption (VO_2), or blood lactate (B_{lac}) at any of the intensities completed during the initial 20-min phase of the trial ($p > .05$). Final 20-km TT times were not significantly different between trials ($p = .115$, eta-squared = .24), but, compared to PLA, PYC-B did result in a significantly faster completion of the final 1 km of the TT by 3.8 s ($p = .033$, ES = 0.62) and a significantly greater 6.2% power output over the final 5 km of the TT ($p = .022$, ES = 0.44). This study suggests that 3 days of supplementing with PYC-B could offer some benefits for cycling performance towards the end of an event when performance is likely to be compromised by accumulated free-radical damage.

Evaluating berry fruits for sustaining health and postexercise muscle recovery

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Adequate recovery after exercise (irrespective of its intensity, duration, or type) is important to allow the up-regulation of cellular adaptive processes that modulate antioxidant capacity, immunity, cell integrity, and energy utilization that serve to prepare the body for future insults. Insufficient recovery time between exercise bouts will result in prolonged oxidative stress, delayed tissue repair, and increased susceptibility to infection, all of which will have a long-term detrimental effect on the ability to train and perform. Traditionally, nutritional supplements, especially those high in powerful antioxidants, are often consumed to prevent oxidative stress and reduce recovery time. However, recent evidence indicates that while dietary antioxidants attenuate oxidative stress, they also block the up-regulation of cellular adaptive processes. Thus, it is preferable that nutritional foods/supplements used in a sports training regimen not only minimize immediate negative consequences of inappropriate or strenuous exercise but also complement long-term benefits provided by cellular adaptive events. The New Zealand Institute for Plant and Food Research Ltd (PFR) is a world-leading plant-science organization with significant unique fruit and vegetable germplasm from large breeding programs. Fruits are rich sources of different bioactive substances, which have potential to benefit human health. We will present data demonstrating that the consumption of certain berry fruits can complement the health benefits of regular exercise through the appropriate modulation of oxidative stress, muscle damage, and immunity, all of which facilitate recovery.

How do teachers in home economics in Norway focus on healthy food, overweight, and obesity in their teaching?

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The topic *food and lifestyle* in the subject *Home economics* in the Norwegian national curriculum focuses on developing motivation and skills to choose a health-promoting lifestyle, in accordance with guidelines for healthy eating from the national health authorities. Teaching in the subject aims to contribute to a lifestyle that reduces risk factors for overweight and obesity

among children and youth (Norwegian Directorate for Education and Training, 2011). The aim of this survey is to find out the extent to which teachers follow the national guidelines for healthy eating and to what extent they look at themselves as resource persons for preventing overweight and obesity. A questionnaire (Questback) containing 33 questions was sent to 420 schools in Norway. Two hundred thirteen teachers responded. Only about 30% of the teachers have formal education in home economics and 56% of the teachers answer that practical teaching is based on the official dietary advice. Eighty-three percent of those who teach in the topic believe that the teaching helps prevent overweight and obesity in large and to some extent. Only 10% answer that they are aware of and use national guidelines to prevent, assess, and treat obesity in children and adolescents (published by Ministry of Health and Care Services, Norway). About 80% of the teachers consider themselves resource persons with regard to the prevention of overweight and obesity. Norwegian home economics teachers take responsibility for health promotion, although there is rather weak influence from the official guidelines on their teaching. They regard themselves as key resource persons in public health and they represent a great potential in promoting a healthy lifestyle in the younger generation. This means that it is of great importance that they have a solid education in the subject. There is therefore a big potential in the topic to work with health-promoting lifestyle.

Long-term effects of daily postmeal physical activity—Preliminary results

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Previous studies have shown that one bout of moderate or light postmeal physical activity effectively blunts the postprandial increase in blood glucose. The purpose of this study was to determine the long-term effects of such activity. Thirty-seven subjects were randomized to an intervention or a control group. They were previously diagnosed as hyperglycemic, or South Asian immigrants with high risk of type 2 diabetes according to Ramachandran's risk score. Control subjects maintained their usual physical activity patterns, while the intervention subjects were instructed to undertake a minimum of 30 min of daily postmeal physical activity in addition to their usual physical activity. Anthropometric measurements and venous blood samples were taken before and after the 12-week intervention period. The subjects kept a physical activity diary and completed a questionnaire on side effects. The intervention subjects performed an average of 1.3 bouts of physical activity each day (usual activity included), starting 29 min after the last meal, lasting 50 min, with an intensity of 11.6 on the Borg RPE scale. A total increase in physical activity level of 40 min/day was reported. Corresponding values for the control group were 0.8 bouts/day, 98 min postmeal, lasting 67 min, 11.3 on Borg RPE, and a change of 10 min/day. In the intervention group we observed that HbA1c was reduced from 6.2% to 6.0% (p = .012). None of the subjects reported any side effects of postmeal physical activity. There were no other tendencies towards glycemic or anthropometric changes in any of the groups. Habitual low-intensity postmeal physical activity may improve HbA1c levels without side effects.

Heart rate variability and moderate-intensity exercise in middle-aged healthy women

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DoH guidelines recommend 30 min moderate-intensity exercise 5 times weekly to maintain cardiorespiratory fitness and health. The aim of the study was to investigate autonomic vagal control of heart rate in response to moderate-intensity exercise in healthy middle-aged women. Twelve volunteers (mean age 48, *s* 4 years; height 1.66, *s* 0.09 m; body mass 70.6, *s* 11.1 kg) completed an orthostatic test prior to a self-selected treadmill walk at a moderate exercise intensity. Postwalk participants again completed an orthostatic test. Heart rate and R-R interval data (RRI) were monitored using telemetry (Polar RS800). Heart rate variability (RMSSD, time-domain; HF, frequency-domain and SD1, Poincaré analysis; as indices of vagal control of heart rate) was assessed from the raw RRI data. The study received university ethical committee approval. Differences before versus after exercise were determined using Student's t test, relationships between measures were assessed by Pearson correlation (SPSS v. 19). Treadmill exercise elicited a heart rate of 113 ± 16 beats/min. After exercise there was an increase in both supine (67 ± 11 vs. 75 ± 14) and standing (77 ± 12 vs. 85 ± 14 beats/min) heart rate ($p < .01$). There was no difference in autonomic vagal response pre- versus postexercise and as a result of orthostasis (Table 1).

Table 1

Measure	Pre-	Post-	*p*
Su RMSSD (ms)	44.4 ± 33.0	30.7 ± 23.3	.081
Su HF (ms^2)	1,117.3 ± 1,501.5	622.9 ± 885.9	.175
Su SD1 (ms)	31.85 ± 23.3	21.8 ± 16.5	.069
St RMSSD (ms)	27.4 ± 18.7	22.6 ± 16.3	.146
St HF (ms^2)	367.0 ± 494.1	238.1 ± 320.2	.109
St SD1 (ms)	19.6 ± 13.3	16.2 ± 11.6	.146
ΔRMSSD (ms)	–17.0 ± 24.0	–8.03 ± 10.8	.195
ΔHF (ms^2)	–750.3 ± 1,291.0	–384.8 ± 696.3	.302
ΔSD1 (ms)	–12.3 ± 16.7	–5.6 ± 7.6	.163

Note. Su = supine; St = standing; Δ = change from supine to standing. The change in autonomic vagal control as a result of orthostasis after exercise was strongly correlated with Baecke Sport score ΔRMSSD (r = –.735), ΔHF (r = –.800), and ΔSD1 (r = –.731; $p < .01$).

From burnout to fat burner: Critically examining the approach and impact of a nutrition and exercise program on a *Men's Health* magazine body transformation

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The pursuit of individual physical health is a key objective of modern society. Numerous popular and academic publications have emerged, reflecting and shaping this interest in personal well-being. In a journalistic context, the health magazine industry is often accused of encouraging image consciousness, promoting particular exercise regimes and nutritional habits for readers in pursuit of a desired physique. By highlighting socially constructed pressures to conform to particular physical forms, some magazines publish articles detailing body transformations, often framed to inspire makeovers. Such renovations can center on unrealistic objectives regarding time frame, weight loss, and muscle building. The typical approach is to present the subject posttransformation and include unflattering "before shots" in an article which discusses how the individual achieved his or her goals. A less common approach is to present a subject before a transformation and follow his or her progress over a longer time period. In 2012, I became one of five *Men's Health* UK "Fat Burners" who did just this, partaking in a 12-month program. *Men's Health* is the world's largest men's magazine brand and the best-selling men's magazine in many of the 44 countries where editions are published. Appearing initially in the January edition, the regular magazine feature followed the progress of the "fat burners," including blogs and photo shoots. This paper critically examines the nutritional and exercise plan adopted for my transformation and the challenges and impact of the experience between first and final photo shoots. The periodized training was characterized by planned progression, featuring strength and high-volume training, with a nutritional plan emphasizing high-density nutrients, based on theories concerning the chemical and hormonal effect of food, rather than the "calorie counting" associated with many diets. It also explores the approach regarding the use of supplements and cleanses.

The effects of Kaloba supplementation on immune response to prolonged exercise

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This study examine the effects of Kaloba (Schwabe Pharma, Germany) supplementation on immune response to prolonged exercise in 9 healthy male recreational athletes (age 21 ± 5 years; BMI 22.4 ± 1.5kg/m^2). Participants cycled for 90 min at 60% VO_{2max} on two trials. Participants came in the morning after an overnight fast during each trial. The second trial was performed after 7 days of supplementation. Kaloba was taken as one 20-mg tablet three times daily. Blood and timed, unstimulated saliva samples were collected before, after, and 1 hr postexercise. Participants also completed the Wisconsin Upper Respiratory Symptom Survey-21 for 7 days after each trial. The whole blood sample was exposed to vaccine and incubated for 20 hr (5% CO_2, 37°C) before being analyzed for cytokines (IL-2, IL-6, IL-8, IL-10, IFN-γ, TNF-α, IL-1α, and IL-1β) level with Evidence Investigator. White blood cells and their differential counts were also measured. Saliva samples were analyzed for the sIgA level by using a Salimetrics ELISA kit. Data analysis was carried out using SPSS (two-way ANOVA with repeated measures and paired *t* test). We found that Kaloba did not show any significant beneficial effects on the parameters measured. However, prolonged moderate exercise significantly decreases sIgA secretion rate and concentration postexercise. However, the values returned to baseline by 1 hr postexercise. White blood cell count was significantly increased postexercise, and was further increased 1 hr postexercise. We conclude that there was no evidence to suggest Kaloba has beneficial effects on immune function before or after exercise. It may be because the dose and length of supplementation of Kaloba in this study was not enough to induce any significant effects of the Kaloba. However, 90 min cycling at moderate intensity temporarily reduces sIgA secretion and increases the white blood cell count.

The effect of fasting on urinary trace element composition

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Fasting during the month of Ramadan involves refraining from ingesting foods/fluids from sunrise to sunset. The aim of this study was to see if there are differences in composition of macro and trace elements in urine from volunteers sampled before and during Ramadan. The volunteers ($N = 36$) were from Leicester, UK (mean age 37 years, *SD* 8 (4 women and 32 men). Each volunteer provided urine samples, completed a questionnaire, and signed an informed-consent form. Three different urine samples were collected as follows: a first morning (fasting) urine sample before Ramadan (BR) and two fasting samples during Ramadan (one in the morning [DR1] and a second one in the evening [DR2] of the same day). The elements Na, K, Mg, Ca, Al, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, As, Se, Sr, Mo, Cd, Cs, Ba, and Pb were determined by inductively coupled plasma mass spectrometry. Wilcoxon signed-rank test revealed significant differences for the following: BR vs. DR1: K (p = .024), V (p = .021), Mn (p = .001), Co (p = .002), As (p = .00), Cs (p = .013), and Ba (p = .002) decreased significantly in DR1; BR vs. DR2: Mg (p = .012), Ca (p = .000), Mn (p = .001), Co (p = .006), As (p = .001), Sr (p = .007), and Ba (p = .000) decreased significantly in DR2; DR1 vs. DR2: K (p = .009), V (p = .024), Cu (p = .048), Se (p = .033), and Cs (p = .003) increased significantly during DR2. Mg (p = .012), Ca (p = .006), Sr (p = .007), Cd (p = .062), and Ba (p = .013) decreased significantly during DR2. When comparing BR with DR1 and BR with DR2, only seven elements (K, V, Mn, Co, As, Cs, and Ba) and seven elements (Mg, Ca, Mn, Co, As, Sr, and Ba), respectively, changed. As, Mn, Co, and Ba are found to be consistently lower for both morning and evening Ramadan urine samples. This suggests altered metabolism of these elements due to changes in biochemical processes and/or due to dietary changes. Factors such as changes in sleeping times and refraining from foods during the day could alter the absorption and metabolism of trace elements. Modification of the gut microflora due to fasting may also play a role. Further

studies are necessary to better understand the health impact of Ramadan fasting.

Normal protein vegetable-based diet suppresses leukocytosis in exercise compared to high-protein nonvegetable diet in women

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Acid-base status has impact on, e.g., exercise performance, calcium metabolism, bone health, and immune functions. Acid-base status can be modulated by nutrition (Kellum et al. *Critical Care* 2004, 8: 331–336). The purpose of this study was to investigate if normal-protein vegetable-based (alkalogenic) and high-protein nonvegetable (acidogenic) diets affect leukocytosis and cortisol response in submaximal and maximal cycling loads. Subjects were 16 healthy normal-weight men and 19 women. The subjects were given exact instructions what to eat during 1 week's nutrition interventions: normal-protein vegetable-based (NPVD) and high-protein nonvegetable (HPND) diets. The nutrition was designed with the help of potential renal acid load (PRAL). In the NPVD diet, PRAL was negative and was assumed to enhance the production of alkali in the body, whereas in HPND, PRAL was positive and was assumed to increase the production of acids. NPVD mainly contained vegetables, fruits, and grain products, whereas HPND contained mainly meat, grain, and dairy products. In crossover design, the subjects performed a submaximal test in which they cycled 3 × 10 min at 35%, 55%, and 75% of VO_{2max}. Finally, the subjects cycled at 100% of VO_{2max} until exhaustion. There was a 4-min break after each 10-min cycling stage during which blood samples were collected. From blood, total white blood cell count (WBC), subpopulations, and cortisol were analyzed. Exercise induced significant ($p < .05$) leukocytosis in 55%, 75%, and 100% loads with both diets. The white blood cell count was significantly ($p < .05$) decreased in men during NPVD. Leukocytosis was significantly ($p < .05$) lower in 75% and 100% loads with NPVD than with HPND in women but not in men. Similar results ($p < .05$) were found in neutrophil and cortisol levels. A diet that produces alkali in the body might be beneficial in prevention of immune and stress perturbations related to high-intensity exercise.

The effect of short-term probiotic supplementation on gut flora of elite athletes

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Optimal immune function is emerging as a key contributor to sporting performance (Berg et al. *Exerc Immunol Rev,*1999, 5, 78–95). There is increasing scientific interest in the prevention and management of gastrointestinal (GI) illness in athletes travelling to countries with varied diet and sanitation conditions. This study aims to examine the effectiveness of probiotic supplementation in altering gut flora and preventing travelers' diarrhea (TD) in elite athletes traveling to a high-risk country. Eight athletes were supplemented for 8 weeks with *Lactobacillus acidophilus, Bifidobacteria lactis,* and *Lactobacillus rhamnosus* (1/day). Stool samples were taken at baseline, directly before traveling (~2 weeks later), and at return. Fluorescent in situ hybridization was used to assess bacterial concentrations of total eubacteria, bifidobacteria, and bacteroides (log_{10} bacteria/g fresh feces), and gas chromatography to assess short-chain fatty acid (SCFA) concentrations (mmol/g fresh feces), of three fecal samples taken at baseline, precompetition, and postcompetition. Participants used a daily log to record symptoms of TD, classified using the World Health Organization (WHO) definition of ≥3 loose or watery stools in a 24-hr period (Allen et al., *Cochrane Review,* 2009, 1, 1–72). There were no statistical changes to total eubacteria, bifidobacteria, bacteroides, or SCFA concentrations, but there was a trend towards an increase for all bacterial groups from baseline to precompetition. Statistically significant relationships ($p \leq .05$) were also detected between average bifidobacteria and n-valeric concentration ($r = .520$) and average bacteroide and n-butyrate concentration ($r = –.557$). Fifty percent of athletes reported TD symptoms. Probiotic supplementation led to small modulations in athlete gut flora that may be clinically relevant to health and indirectly to performance. Supplementation was unable to prevent episodes of TD in 50% of athletes.

The influence of simple sugars on gut hormone response and gastric emptying rate

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The intake of large quantities of fructose in the diet and overconsumption of sugary foods and beverages have been suggested to contribute to the development of the metabolic syndrome and obesity epidemic. The effect of different carbohydrates on gastrointestinal hormone response and gastric emptying (GE) rate are an important consideration in the pathogenesis of these disorders. This study aimed to examine the GE rate and gut hormone responses of different oral carbohydrate solutions. Gastric emptying rate and gut hormone responses of 595 ml water (W) and 6% glucose (G), fructose (F), sucrose (S), and combined glucose/fructose (C) solutions were examined in 7 healthy men in a randomized single-blind crossover design. Gastric emptying was assessed over 60 min using the [^{13}C] acetate breath method. Blood was collected at regular intervals, and the serum concentration of acylated ghrelin (GHR), active glucagon-like peptide-1 (GLP-1), glucose dependent insulinotropic hormone (GIP), and insulin determined. Water emptied fastest, followed by F, C, S, then G with mean half-emptying times of 45 ± 5, 53 ± 7, 58 ± 26, 70 ± 40, and 96 ± 63 min, respectively ($p = .136$). Times of maximal emptying rate were 33 ± 3, 37 ± 7, 30 ± 7, 25 ± 18, and 51 ± 26 min for W, F, C, S, and G, respectively, with G greater than S ($p < .05$). GHR area under curve (AUC) for F was smaller than W (9,279 ± 3,509 vs. 12,033 ± 4,278 pg/ml 1 hr, $p < .05$). Differences in GLP-1 AUC tended to significance ($p = .064$). GIP AUC for G (2,985

± 1,178 pg/ml 1 hr), S (1,900 ± 711 pg/ml 1 hr), and C (2,042 ± 777 pg/ml 1 hr) was greater than W (523 ± 197 pg/ml 1 hr; $p < .01$) and F (609 ± 271 pg/ml 1 hr; $p < .05$). Insulin response followed the same response pattern as GIP. In conclusion, GE characteristics and gut hormone responses differ greatly between the simple sugars tested. The consequence of faster GE and reduced gut hormone response to increased fructose consumption should be further investigated.

Effect of dieting and low-intensity, long-term aerobic training on serum lipid profiles of obese young males

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This study examined the effect of low-intensity long-term training—with and without dieting—on lipid profiles of obese youth males in Saudi Arabia. Twenty-four students whose BMI was more than 30 were selected at random and divided into two groups. Both groups trained at low intensity for 30–35 min three times per week for 12 weeks. Group 1 followed a low-energy (1,500 kcal/day) diet. Serum lipids and lipoproteins were measured 24 hr before and 24 hr after the training program. The data collected from the two groups before and after the training program were analyzed with dependent *t* test and analysis of covariance (ANCOVA). Whenever *F* ratio was found to be significant, Scheffé's post hoc test was followed to determine which of the paired mean differences were significant. In all cases, level of confidence was fixed at .05. The mean of the pre- and posttests of Group 1 for triglycerides were 146 and 122 ($p < .05$), respectively, and for Group 2 were 144 and 115. Scheffé's post hoc test and ANCOVA were applied between the adjusted posttest paired mean of triglycerides for Group 1, which showed the tendency for decreasing triglycerides. With respect to HDL, the pre- and postintervention means for Group 1 were 41.4 and 46.0 and for Group 2 were 41.8 and 49.3, respectively. LDL pre- and post-test mean values for Group 1 were 133.8 and 116.5 and for Group 2 131.2 and 101.1, respectively. After analyzing the obtained value using ANCOVA and Scheffé's post hoc test on LDL, Group 1 showed a greater reduction in LDL. There was a greater reduction in VLDL for Group 1 than for Group 2, whereas there was no difference between groups in the response of LDL. There was also a greater loss of body mass in Group 1 than in Group 2.

Wheat protein enzymatic hydrolysate supplementation has a positive impact for muscle mass during exercise training in middle-aged and elderly individuals

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Aging is associated with muscle loss, due to imbalance of protein turnover, and it has been suggested that an increase in protein intake enhances the synthesis rate of muscle proteins in older individuals. Glutamine is known to increase in the secretion of anabolic hormones, and large amounts of glutamine are contained in wheat protein known as gluten. However, there is little known about the influence of exercise training with wheat gluten hydrolysate (WGH) supplementation in humans. Therefore, the purpose of this study was to investigate the effects of exercise training with WGH supplementation on muscle mass in middle-aged and elderly individuals. Twenty-five healthy middle-aged and elderly individuals completed the exercise training program for 3 months. They were randomly assigned to the exercise training with WGH supplementation group and the exercise training only group (EXE). Before and after the exercise training period, body composition and maximum isometric force of knee extension and knee–hip extension movements were measured. EXE was administered total 1.5 g containing sugar (77.3%) as a placebo, while WGH was administered total 1.5 g containing wheat gluten hydrolysate (66.1%), chondroitin sulfate (10.4%), and vitamin B (0.7%). Both WGH and EXE groups had significant decreases in body weight and body fat and increases in knee-extension and leg-extension force-generating capacity. The EXE group showed a decrease in muscle mass, but WGH groups did not. Our results suggest that it is possible to gain muscle strength without muscle loss after 3 months of exercise training with WGH supplementation. WGH supplementation may be a potential supplement to modulate muscle protein metabolism and maintain muscle mass.

Influence of sedentary lifestyle on body weight in Qatari schoolchildren

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The aim of this study was to find the prevalence of overweight and obesity among Qatari schoolchildren in the age group 6–12 years and assess the lifestyle of Qatari schoolchildren and its association with overweight and obesity. The study was conducted on a sample of Qatari schoolchildren. A representative sample (1,500 children) were selected between the ages of 6 and 12 from 23 schools using multistage cluster random sample, while 200 cases from each age group were targeted as primary sampling units. Data about number of physical education classes, hours of physical activity per week, and the sedentary lifestyle were obtained by utilizing a standardized self-administered questionnaire. The current results showed that the percentage of body weight for Qatari children was higher than the reference values, while their body height percentage was lower than the reference. Using the WHO (2007) classification of BMI for children, 8%, 16%, and 23% of studied children had thinness, overweight, and obesity, respectively. The majority of children (55%) spent more than 2 hr daily watching TV, using the Internet, or playing electronic games; 26% did not report any kind of physical activity; and 49% had physical activity of less than 1 hr/day. The current study showed that there is a significant relation between children's physical activity and their prevalence of overweight and obesity. The current work therefore looks at schoolchildren in Qatar to create a more complete picture of the current state of health and to help determine how lifestyle and environmental changes can be mitigated as a causal factor of obesity and therefore lifelong poor health.

Physical activity and quality of life among older people in rural Chainat, Thailand

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Physical activity helps to promote healthy aging and reduces the decline of capacity in aging. International literature indicates a positive relationship between physical activity and quality of life (QOL) among older people (Elavsky et al., *ABM* 2005, 30**,** 138–145; Acree et al., *HQLO* 2006, 4**,** 37; Mcauley et al., *ABM* 2006, 31**,** 99–103; White et al., *HQLO* 2009, 7**,** 10). However, there appears to be limited evidence for a relationship between physical activity and quality of life among older people in rural Thailand. This descriptive cross-sectional study investigated the association between physical activity and quality of life among older people in rural Thailand. One hundred nine people age 60 and over living in the rural areas of Chainat Province, Thailand, were recruited using stratified random sampling. Data were collected with Physical Activity Scales for the Elderly (PASE) and Health Related Quality of Life Questionnaire (HRQOL). These were administered using face-to-face structured interviews and analyzed using multiple logistic-regression analysis. Main findings demonstrated that the total score of physical activity influenced level of health related to quality of life (HRQOL; p = .022). A high level of HRQO was significantly associated with a low level of physical activity (p = .006, OR = 5.51, 95%CI = 1.64–18.48) and low level of leisure-time activity (p = .019, OR = 3.98, 95%CI = 1.25–12.65). Low level of leisure-time activity was found to be an alternative strategy to enhance physical activity and quality of life among older people in rural Thailand. Further mixed-methods research is required to replicate this study in urban and rural areas in other provinces of Thailand. This should establish the generalizability of these findings and enable some determination of the extent to which leisure activities for this age group may be affordable and practical.